

## PROCESS FOR MAKING A FIBER PRODUCT FROM WASTE FIBER

### FIELD OF THE INVENTION

The present invention relates to a process for making a fiber product from waste  
5 fiber recovered from a virgin fiber pulp or paper making process.

### BACKGROUND OF THE INVENTION

During the pulping process, the pulp is washed with water to remove impurities  
and screened to remove over-sized particles. The particles removed from the washing  
10 and screening steps is referred to as clarifier fiber, sludge or waste cellulose fibers.  
Clarifier sludge includes, but is not limited to, short fibers, extremely large fibers, fiber  
bundles, and inorganic contaminants collected from pulp processing water. Historically,  
clarifier sludge or waste fiber has been burned as boiler fuel, or sent to landfills.

Animal or pet bedding/litter is used in pet cages, houses or litter boxes. For most  
15 animals, the animal bedding absorbs wetness and makes the area easier to clean. For  
burrowing types of animals, such as rodents and rabbits, the bedding is used by the pets to  
create a nest in their cage. The bedding may be used for dogs in houses, kennels and  
whelping boxes to provide a cleaner and drier environment. Bedding may also be used in  
cages for snakes and other exotic animals.

## SUMMARY OF THE INVENTION

- The present invention provides a process for making a fiber product. The process comprises providing never-dried waste fiber from a virgin fiber source. The virgin fiber  
5 source may be a pulp or paper making process which utilizes wood chips for furnish. The waste fiber is dewatered using a suitable dewatering device, such as a screw press. The waste fiber is then flaked with a suitable flaker, such as a pin mill. Then, the waste fiber is dried. In one embodiment of the invention, the waste fiber is dried utilizing at least a portion of recovered heat from a pulp or paper-making process.
- 10 The present invention also provides a method for making animal bedding. The animal bedding is made by providing a never-dried waste fiber from a virgin fiber source. The waste fiber is dewatered using a suitable dewatering device, such as a screw press. The waste fiber is then flaked with a suitable flaker, such as a pin mill. Then, the waste fiber is dried.
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## DETAILED DESCRIPTION OF THE INVENTION

The present invention provides a process for making a fiber product. The fiber product is useful for many purposes, such as a hydrophilic absorbent medium, a  
20 hydrophobic absorbent medium and animal bedding.

The fiber product is made from a never-dried, waste fiber from a virgin cellulose fiber source. The pulp may be bleached pulp, unbleached pulp, mechanical pulp, chemical pulp, dissolving grade pulp, or any other type of virgin fiber pulp. Virgin fiber sources are pulping or paper processes which utilize virgin fiber. Virgin fiber is made  
25 from wood chips. In other words, a virgin fiber process has virtually no, or only minor amounts of, secondary fiber providing furnish to the process. Secondary fiber is fiber derived from post-consumer recycling, such as old corrugated containers.

During the pulping or paper-making process, solid materials, including cellulose fibers, collect in the waste water. These solids are removed from the waste water systems  
30 prior to the waste water discharge. Some of these solids, or sludge, are derived from the

fiber furnish when it is screened prior to processing to removed grossly oversized materials. After digesting, grossly oversized materials, such as uncooked knots or large slivers, shives and unground pieces of fiber, are removed which become part of the sludge.

5        Additionally, in a bleached pulp/paper system, sludge may be derived from the bleaching screening and cleaning prior to the pulp or paper machines. Sludge is also derived from accidental spills or overflows in the plant which are swept into the sewage system. Also, in a pulp or paper-making facility, materials may be purposely dumped or washed from equipment during maintenance or prior to making grade changes in the  
10      product. These removed materials, or rejects, become a portion of a waste fiber, clarifier fiber, clarifier sludge or sludge stream.

The waste fibers are part of a stream which is generally less than about 1% consistency. The stream is passed through a dewatering device to raise the consistency. The dewatering device may include a screw press or belt press. Typically, the dewatering  
15      device will have removed a portion of the water from fiber to increase the consistency to anywhere in the range of about 10% to about 55%. In one embodiment of the invention, the consistency of the fiber coming out of the dewatering device should be about 20% to about 50%.

The dewatered stream is then passed through a flaking device to break the waste  
20      fibers into smaller agglomerations of fibers. The flaking device may be a pin fluffer, pin mill or any other suitable fiber flaking device, such as the flakers described in co-pending U.S. Patent Application No. 10/674609, entitled "Method for Conveying, Mixing and Leveling Dewatered Pulp prior to Drying," all of which are expressly incorporated herein by reference

25      The fiber stream is then dried to a moisture content of less than about 10% moisture. In one embodiment of the invention, the fiber agglomerations retain their bulk, fibrous structure and appearance after drying. The dryer may include a belt dryer, vacuum dryer, fluid bed dryer, cylinder dryer, or cylinder dryer. However, by way of non-limiting example, the drier may include a belt dryer such as a Dry-Rex™ belt dryer  
30      of the type manufactured by Solutions Mabarex Inc. of Saint-Laurent, Canada.

In another embodiment of the invention, the dryer utilizes at least a portion of waste heat or recovered heat from the pulping or paper-making process. The waste heat

may be derived from hot mill effluent, bleach plant effluent, TMP hot water loop, low pressure steam, flue gas, scrubber water, lime kilns, gasification, pyrolysis, heat-pumps and any other hot processes. The waste heat may be direct or indirect heat, such as heat from a heat exchanger used in the process.

5       The fiber may be treated with a treatment substance, which may include, but is not limited to, surfactants, crosslinkers, hydrophobic materials, mineral particulates, other materials for specific end-use fiber properties, and combinations of treatment substances. The term surfactant includes, but is not limited to oil in water emulsions; surfactants disclosed in U.S. App. No. 08/509,401 to Graef et al.; U.S. Pat. No. 3,554,863 to Hervey  
10 et al.; U.S. Pat. No. 6,074,524 to Wu et al.; U.S. Pat. No. 6,159,335 to Owens et al.; and Canadian Pat. No. 947915 to Angel et al.; all of which are expressly incorporated herein by reference. Surfactants impart desirable properties to pulp fibers such as reducing fiber to fiber bonding, improving absorbency or reducing friction of finished webs. Surfactants are used in tissue and towel manufacturing, and are used extensively in the textile  
15 industry for numerous enhancements. The classes of surfactants include anionic, cationic, nonionic, or ampholytic/zwitterionic surface active materials. Examples of *anionic* surfactants include sodium stearate, sodium oleate, sodium dodecyl sulfate, sodium dodecyl benzene sulfonate, polyether sulfate, phosphate, polyether ester and sulfosuccinate. Examples of cationic surfactants include dodecylamine hydrochloride,  
20 hexadecyltrimethyl ammonium bromide, cetyltrimethyl-ammonium bromide, and cetylpyridinium bromide. One class of surfactant is cationic surfactants based on quaternary ammonium compounds containing fatty type groups. Examples of *non-ionic* surfactants include polyethylene oxides, sorbitan esters, polyoxyethylene sorbitan esters, and alkylaryl polyether alcohols. An example of *ampholytic or zwitterionic* surfactant is  
25 dodecyl betaine. Examples of commercial surfactant are Akzo Nobel's Berolcell 587K which is a cationic surface active agent and Process Chemicals, LLC Softener CWW which is a cationic surfactant used as a yarn lubricant. Other suitable commercial surfactants include Berol<sup>TM</sup> 509 available from Akzo Nobel.

30       The term crosslinker includes, but is not limited to, polyacrylic acid; glyoxol; crosslinkers disclosed in U.S. App. No. 08/509,401 to Graef et al.; and U.S. App. No. 60/251,999 to Graef et al.; all of which are expressly incorporated herein by reference. The term hydrophobic material includes, but is not limited to, latex, sizing

agents used to treat pulp such as alkyl ketene dimer or alkenyl succinic anhydride, waxes, oils, or other chemicals that react with the fiber and render the surface hydrophobic. The term mineral particulate includes, but is not limited to, clay, calcinated clay, calcium carbonate, calcium sulfate, zinc oxide, talc, titanium dioxide, silicas, fly ash, sodium 5 aluminosilicates, zeolites, sodium solicates, sodium silicates or other minerals.

More than one treatment substance may be applied to the fiber either before dewatering, before flaking, before drying or after drying. The treatment substance may include binder molecules and particles, where the binder molecules are first applied to the fibers and then the particles are added to the binder molecule coated fibers thus binding 10 the particles to the fibers (as disclosed in U.S. Pat. No. 5,641,561 to Hansen et al., which is expressly incorporated herein by reference). Other fiber treatment substances and methods known in the art may be used without departing from the present invention.

Additional treatment substances may be added to cause an *in situ* precipitation. When *in situ* precipitation is desirable, a first mineral treatment substance is added to the 15 fiber, then a second treatment substance is added to the fiber. The first and second treatment substances react to form a precipitate treatment substance. For example, dissolved calcium hydroxide may be used as the first treatment substance and dissolved sodium bicarbonate may be used as the second treatment substance. The calcium hydroxide and sodium bicarbonate react to precipitate calcium carbonate. Other 20 precipitate treatment substances may be formed for treating the fiber including, but is not limited to, calcium aluminum silicates, calcium aluminum carbonates, calcium aluminum phosphates, or other mineral precipitates.

While the different embodiment of the invention has been illustrated and described, it will be appreciated that various changes can be made therein without 25 departing from the spirit and scope of the invention.